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INTERNATIONAL PRELIMINARY EXAMINATION REPORT

(PCT Article 36 and Rule 70)

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Applicant's or agent's file reference ps2878	FOR FURTHER ACTION	See Notification of Transmittal of International Preliminary Examination Report (Form PCT/IPEA/416).
International Application No. PCT/AU2003/000707	International Filing Date (day/month/year) 10 June 2003	Priority Date (day/month/year) 11 June 2002
International Patent Classification (IPC) or national classification and IPC Int. Cl. ⁷ F16P 3/14, B30B 15/10		
Applicant DAVIES, Kevin Stephen		

1. This international preliminary examination report has been prepared by this International Preliminary Examining Authority and is transmitted to the applicant according to Article 36.
2. This REPORT consists of a total of 4 sheets, including this cover sheet.

This report is also accompanied by ANNEXES, i.e., sheets of the description, claims and/or drawings which have been amended and are the basis for this report and/or sheets containing rectifications made before this Authority (see Rule 70.16 and Section 607 of the Administrative Instructions under the PCT).

These annexes consist of a total of 9 sheet(s).

3. This report contains indications relating to the following items:

- I Basis of the report
- II Priority
- III Non-establishment of opinion with regard to novelty, inventive step and industrial applicability
- IV Lack of unity of invention
- V Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement
- VI Certain documents cited
- VII Certain defects in the international application
- VIII Certain observations on the international application

Date of submission of the demand 8 December 2003	Date of completion of the report 21 June 2004
Name and mailing address of the IPEA/AU AUSTRALIAN PATENT OFFICE PO BOX 200, WODEN ACT 2606, AUSTRALIA E-mail address: pct@ipaaustralia.gov.au Facsimile No. (02) 6285 3929	Authorized Officer O L HAGGAR Telephone No. (02) 6283 2109

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/AU2003/000707

I. Basis of the report

1. With regard to the elements of the international application:*

 the international application as originally filed. the description, pages 1, 2, 4 – 12, as originally filed,

pages , filed with the demand,

pages 3, received on 19 May 2004 with the letter of 19 May 2004

 the claims, pages , as originally filed,

pages , as amended (together with any statement) under Article 19,

pages , filed with the demand,

pages 13 – 20, received on 19 May 2004 with the letter of 19 May 2004

 the drawings, pages 1 – 6, as originally filed,

pages , filed with the demand,

pages , received on with the letter of

 the sequence listing part of the description:

pages , as originally filed

pages , filed with the demand

pages , received on with the letter of

2. With regard to the language, all the elements marked above were available or furnished to this Authority in the language in which the international application was filed, unless otherwise indicated under this item.
These elements were available or furnished to this Authority in the following language which is: the language of a translation furnished for the purposes of international search (under Rule 23.1(b)). the language of publication of the international application (under Rule 48.3(b)). the language of the translation furnished for the purposes of international preliminary examination (under Rules 55.2 and/or 55.3).

3. With regard to any nucleotide and/or amino acid sequence disclosed in the international application, the international preliminary examination was carried out on the basis of the sequence listing:

 contained in the international application in written form. filed together with the international application in computer readable form. furnished subsequently to this Authority in written form. furnished subsequently to this Authority in computer readable form. The statement that the subsequently furnished written sequence listing does not go beyond the disclosure in the international application as filed has been furnished. The statement that the information recorded in computer readable form is identical to the written sequence listing has been furnished4. The amendments have resulted in the cancellation of: the description, pages the claims, Nos. the drawings, sheets/fig.5. This report has been established as if (some of) the amendments had not been made, since they have been considered to go beyond the disclosure as filed, as indicated in the Supplemental Box (Rule 70.2(c)).**

* Replacement sheets which have been furnished to the receiving Office in response to an invitation under Article 14 are referred to in this report as "originally filed" and are not annexed to this report since they do not contain amendments (Rules 70.16 and 70.17).

** Any replacement sheet containing such amendments must be referred to under item 1 and annexed to this report

INTERNATIONAL PRELIMINARY EXAMINATION REPORT

International application No.

PCT/AU2003/000707

V. Reasoned statement under Article 35(2) with regard to novelty, inventive step or industrial applicability; citations and explanations supporting such statement**1. Statement**

Novelty (N)	Claims 1 – 47	YES
	Claims NIL	NO
Inventive step (IS)	Claims 1 – 47	YES
	Claims NIL	NO
Industrial applicability (IA)	Claims 1 – 47	YES
	Claims NIL	NO

2. Citations and explanations (Rule 70.7)

The following international search report citations have been considered for the purpose of this statement:

- D1 WO 1997/025568 A
- D2 WO 2000/067932 A
- D3 AU 27084/92 A
- D4 EP 0995942 A

Novelty (N) Claims 1 – 47

The claims are novel in the light of each of D1 – D4. The citations disclose safety systems which utilise a plurality of discrete laser beams arranged around a moving part of a machine to detect the presence of obstructions. The use of such narrow beams means that while obstructions can be detected at certain points around the moving part, the exact location and extent of the obstruction cannot be determined. This can result in hazardous situations if the obstruction is located between the beams and therefore not detected. On the other hand, the claimed safety system provides an illumination region around a portion of the path of movement of the machine part which removes the possibility of obstructions being undetected at locations between beams. This also allows the boundaries of any obstructions in the illumination region to be determined, and movement of the machine part to be accordingly controlled.

Inventive step (IS) Claims 1 – 47

The claims involve an inventive step for the same reasons as above.

Industrial applicability (IA) Claims 1 – 47

The claims satisfy the requirements for industrial applicability.

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VI. Certain documents cited**1. Certain published documents (Rule 70.10)**

Application No. Patent No.	Publication date (day/month/year)	Filing date (day/month/year)	Priority date (valid claim) (day/month/year)
P, A WO 2003/080268 A	2 October 2003	27 March 2003	27 March 2002

This citation discloses the region perpendicular to the path of the movement of machinery part being illuminated by a plurality of discrete planar laser beams, ie. there are gaps between the light beams.

2. Non-written disclosures (Rule 70.9)

Kind of non-written disclosure	Date of non-written disclosure (day/month/year)	Date of written disclosure referring to non-written disclosure (day/month/year)

The present invention attempts to overcome at least in part some of the aforementioned disadvantages of previous safety systems used for detecting the presence of obstructions in hazardous areas around machines having moving parts.

SUMMARY OF THE INVENTION

- 5 In accordance with one aspect of the present invention there is provided a safety system for use with a machine having a moving tool arranged to move through a known path of movement, the safety system being arranged to detect the presence of an obstruction in a region around a portion of said path deemed to be hazardous, the safety system characterized by comprising:
- 10 a light emitting means arranged to emit light generally perpendicular to the path of movement of the tool such that said region is illuminated;
- a light receiving means arranged to receive light from the light emitting means which has passed through said region; and
- a processing and control means arranged to receive information from the light receiving means and determine whether an obstruction exists in said region by the presence of one or more shadow regions cast on the light receiving means by the obstruction and to control movement of the tool dependent on the presence of obstructions in said region.

DESCRIPTION OF THE DRAWINGS

- 20 The present invention will now be described, by way of example, with reference to the accompanying drawings, in which:
 - Figure 1a is a view of a light emitting means and lens arrangement for illuminating a region under the tool, in accordance with the present invention;
 - Figure 1b is a view of an alternative embodiment of a light emitting means and lens arrangement for illuminating the region under the tool;
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CLAIMS

1. A safety system for use with a machine having a moving tool arranged to move through a known path of movement, the safety system being arranged to detect the presence of an obstruction in a region around a portion of said path deemed to be hazardous, the safety system characterised by comprising:
 - 5 a light emitting means arranged to emit light generally perpendicular to the path of movement of the tool such that said region is illuminated;
 - a light receiving means arranged to receive light from the light emitting means which has passed through said region; and
- 10 a processing and control means arranged to receive information from the light receiving means and determine whether an obstruction exists in said region by the presence of one or more shadow regions cast on the light receiving means by the obstruction and to control movement of the tool dependent on the presence of obstructions in said region.
2. A safety system in accordance with claim 1, characterised in that the processing and control means includes software residing on a computer having a memory means, wherein the processing and control means stores in the memory means the image received by the light receiving means when no obstructions are present in the region and compares the current image received by the light receiving means with the stored image of the unobstructed region and allows continued movement of the tool if the images are the same.
- 15 3. A safety system in accordance with claim 1 or 2, characterised in that the processing and control means either slows or stops the movement of the tool if the processing and control means determines the presence of an obstruction in the region.
- 20 4. A safety system in accordance with claim 3, characterised in that an input means is provided such that when the processing and control means slows or stops the movement of the tool, actuation of the input means by the operator informs the processing and control
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means that continued movement of the tool is safe and the processing and control means resumes movement of the tool.

5. A safety system in accordance with any one of the preceding claims, wherein the processing and control means is arranged to determine the vertical distance between a forward edge of the tool and an obstruction casting a shadow on the light receiving means and allows continued movement of the tool if the distance determined is greater than the distance required to stop the tool.
6. A safety system in accordance with claim 5, characterised in that the processing and control means is arranged to determine the thickness of an obstruction casting a shadow on the light receiving means and allow continued movement of the tool should the thickness be less than a predetermined value, the predetermined value being a value determined to be small enough that the obstruction could not be a part of the operator's body.
10. A safety system in accordance with any of claims 2 to 6, characterised in that the processing and control means stores in the memory means one or more maps made up of image information received by the light receiving means as the tool moves through the tool's path of movement, the or each map being determined to be safe for continued operation of the tool.
15. A safety system in accordance with claim 7, characterised in that the processing and control means compares the image received by the light receiving means to the maps stored in the memory means and allows continued operation of the tool if the same.
20. A safety system in accordance with claim 7, characterised in that the operator is provided with a means to instruct the processing and control means to store the image information created by the current pass of the tool in the memory means as a safe map.
25. A safety system in accordance with any one of the preceding claims, characterised in that the light emitting means creates a generally parallel beam of light.

11. A safety system in accordance with any one of the preceding claims, characterised in that the light receiving means is a charge coupled device.
12. A safety system in accordance with any one of the preceding claims, characterised in that the light receiving means comprises a projection screen and a camera arranged to observe the image on the projection screen.
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13. A safety system in accordance with claim 12, characterised in that the charge coupled device utilises a relatively fast shutter speed to reduce the effects of ambient light.
14. A safety system in accordance with any one of the preceding claims, characterised in that the light receiving means and the light emitting means are mounted to be stationary relative to the tool.
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15. A safety system in accordance with any one of the preceding claims, characterised in that a shadow mask is provided on the light emitting means and the processing and control means is arranged to recognise the shadow created by the shadow mask on the light receiving means to determine that the light emitting means is functioning.
16. A safety system in accordance with claim 15, characterised in that a second shadow mask is provided also on the light receiving means and the processing and control means is arranged to detect whether the shadow mask of the light emitting means is in alignment with the second shadow mask of the light receiving means to determine if the safety system is in correct alignment.
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17. A safety system in accordance with any one of the preceding claims, characterised in that a display device is provided to display the images received by the light receiving means.
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18. A safety system in accordance with any one of the preceding claims, characterised in that the light emitting means comprises a light source and one or more transmitting end

lenses, the light source being arranged to transmit generally parallel to an axis parallel to the forward edge of the tool and through the region.

19. A safety system in accordance with any one of the preceding claims, characterised in that one or more receiving end lenses are provided adjacent the light receiving means and 5 the light receiving means is oriented to receive light passing through the receiving end lenses.

20. A safety system in accordance with any one of the claims 1 to 17, characterised in that the light emitting means includes a light source and a transmitting end mirror, the light source being arranged to transmit light generally perpendicular to an axis parallel to the 10 forward edge of the tool onto the transmitting end mirror such that the light is reflected to pass through the region.

21. A safety system in accordance with claim 19, characterised in that the transmitting means includes two transmitting end convex lenses, the two transmitting end convex lenses being arranged such that the light reflected from the transmitting end mirror passes through 15 the two transmitting end convex lenses.

22. A safety system in accordance with any one of the preceding claims, characterised in that a receiving end mirror is provided adjacent the light receiving means, the receiving end mirror being arranged to reflect light that has passed through the region onto the light receiving means, the light receiving means being arranged to receive light travelling 20 generally perpendicular to the axis parallel to the forward edge of the tool.

23. A safety system in accordance with claim 22, characterised in that two receiving end convex lenses are provided, the two receiving end convex lenses being arranged such that the light travelling along the axis parallel to the forward edge passes through the two receiving end convex lenses before being reflected by the transmitting end mirror.